Under High Pressure: Online Measuring Technology in the Autoclave

CUTEC NEWS

FACTS · INFORMATION · ANALYSES

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Accept no compromises!

Wherever people live and work together, conflicts will inevitably occur from time to time. Often enough, these conflicts are "settled" by unacceptable compromises, which are grudgingly tolerated by all concerned – or have to be tolerated in the absence of a better solution. Of course, such a compromise is never regarded as fair by anyone, and it usually does not last very long, either. In dealing with customers, a situation of this kind often means the end of a business relation. Instead of trying to find the least common denominator, the "potential difference" which results from a conflict should be understood as a chance to develop appropriate strategy or even an opportunity for innovation.

In any case, our scientist, Mr Schläfer, was not willing to accept such a compromise. The gas generation potential of certain biomasses in the absence of air had to be determined in the laboratory. The objective was to provide an explanation of the anaerobic digestion profile and thus to optimise the generation of methane. However, he was not satisfied with conventional methods, which simply did not offer the required accuracy, reliability, and reproducibility …. The result is a new technique which makes life easier for him – a biogas measurement free of compromises. You can read about it yourself on page 3.

Furthermore, intensive work is in progress at CUTEC in the fields of anaerobic digestion as well as gasification of biomass. The objective of both endeavours is the utilisation of biomass as a source of energy, either for combined heat and power units (simultaneous generation of electric power and heat) or for use as automobile liquid fuel after further processing by synthesis.

Because of the distinctively higher energy conversion density and the resulting higher specific fuel mass flow rate, the latter alternative still appears to be reserved for gasification at present. A weakness of anaerobic digestion is evident in this case: The process is relatively slow (induced by bacteria at a somewhat higher ambient temperature) and requires correspondingly large volumes. Consequently, our aim must be the intensification of anaerobic digestion processes. Hence, a prerequisite for designing an anaerobic digestion plant is to optimise the bacterial conditions to match the respective biological starting materials as far as possible. For this purpose, reproducible laboratory tests with reliable results – that is, without compromises – with the Schläfer apparatus are absolutely necessary. To come to a full circle: If we all try, as far as possible, to avoid compromises in dealing with one another, both privately and professionally, we can help to improve the quality of life for everyone.

Yours, Otto Carlowitz

Note regarding the supplement:
In this issue, you will find a supplement on a training on solid waste management and landfill development of top Nigerian officials at CUTEC, Germany

IN THIS ISSUE

The first trainee

From year to year we have observed a persistent tight situation on the traineeship market. We at CUTEC are trying – within the limits of our possibilities – to improve this situation.

Since 1st January 2004, the first trainee has been employed at our Institute. Dennis Mahlert is receiving his training as an accountant in the Management. For his instructor, Mr Röneke, a prime objective is to provide Mr Mahlert with the necessary qualifications in all fields of accounting and management.

Further traineeships are planned in the mechanical and electrical workshops as well as in the analytical laboratory, and will probably become available in the summer.

(he/wes)

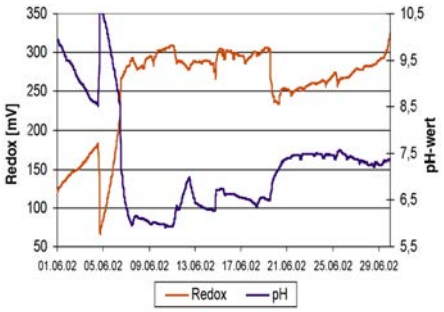
Mr Mahlert at his place of work

PREWIN Conference at the CUTEC Institute

On 13th and 14th November 2003, the conference of the European Network PREWIN (Performance, Reliability and Emission Reduction in Waste Incinerators) was held in the Harz Mountains. The coordinator was JRC (Joint Research Center of the European Union) in Petten. After the opening day in Goslar, which was organised by Uhlig Rohrbogen of Langelsheim, the participants met at CUTEC in Clausthal-Zellerfeld on Friday. The Institute is an approved member of the network. In various talks in the presence of about 50 guests, current projects as well as potential cooperation were discussed. During the visiting tour which followed, the international guests were informed of the possibilities offered by the Institute. The equipment at the Department of Thermal Processes was the subject of special attention. Further opportunities for maintaining personal contacts were offered at the next meeting in Stockholm on 12th and 13th May 2004. (vd)

Development of an Online Measuring Technique for Autoclave Operation

Autoclave technology is generally applied for accelerating the reaction kinetics of dissolution and precipitation processes in hydrometallurgy, for the synthesis of chemical products, etc. In the case of material mixtures, the equilibrium constants cannot be calculated exactly at elevated temperatures and pressures. Reactions such as dissolution, precipitation, crystallisation, and phase transformations, which frequently proceed in parallel in the autoclave, cannot be determined online. The technical prerequisites for the measurement of pH values, conductivities, redox potentials, and concentration distributions are not satisfied. The objective of the AIF-supported project is the development of an online measuring technique for autoclave operation. Project partners are Prof. Dr.-Ing. E. Gock, Institute for Mineral Processing and Waste Disposal / TU Clausthal and Lhotzky & Partners / Braunschweig. The online measuring technique has already been applied at low pressure by the partners for determining the pH value, conductivity, redox potential, and concentration distribution. With a design modification in the by-pass of an autoclave with an agitating device, the online technique is to be extended to the high-pressure range. The functional capability of the measuring technique thus developed is to be tested on the basis of the time-dependent conversion for thermodynamically well-founded reactions. For accelerating the reaction kinetics, pressures up to 30 bar and temperatures up to 180 °C are applied. (ze)



Example of online measurement on a test material at low pressure (30 days)

Description of a department:

Environmental Economics, Environmental Law, and Technololgy Assessment under New Leadership

Prof. Dr. Bernd Heins has become Director at the Department of Environmental Economics, Environmental Law, and Technology Assessment as of 1st January 2004.

The department accompanies and supplements the predominantly technical topics at CUTEC. Current fields of activity in the form of internal competence centres and initiatives have been added to the department portfolio; these functions are particularly important in view of the increasing international activities.

1. Competence Centre for Human Factor, Risk and Disaster Management

In cooperation with the Carl von Ossietzky University in Oldenburg, a Competence Centre for Human Factor, Risk and Disaster Management is currently under development. The purpose of the centre is to assume the functions of the Störfallkommission (Major Hazard Commission), which has been concerned with these topics on the initiative of the German Federal Ministry of the Environment and of the OECD, and to pursue them further on a scientific basis. Besides scientific project work, plans include consulting activities for business and industry, the establishment of an

Prof. Heins (centre) surrounded by his team

expert network and knowledge pool on an Internet portal, as well as the establishment of a joint master's degree program in risk management at the Technical University of Clausthal and the University of Oldenburg.

2. Competence Centre for Climate and Energy Economics (KKE)

This recently established competence centre at CUTEC Institut GmbH is operated in cooperation with Prof. Dr. Wolfgang Ströbele, who holds the professorship in theoretical economics at the Westfälische Wilhelms-Universität in Münster. The purpose of the competence centre is to provide technical and economic appraisal and consulting for companies affected by emission trading on a national level as well as on an international level within the scope of Joint Implementation (JI) and Clean Development Mechanism (CDM) projects. Moreover, the economic effects of emission trading on companies and national economies are to be analysed and evaluated.

3. Innovation Initiative for the Deutsche Mittelstandsagentur Umwelt (DMU)

Die Deutsche Mittelstandsagentur Umwelt – DMU (German Environmental Agency for Medium-Sized Enterprises) is an innovation initiative of CUTEC-Institut GmbH. It offers services in connection with knowledge and technology transfer for small and medium-sized enterprises. In many cases, these companies cannot afford to establish contacts and maintain business relations on their own, especially in foreign countries. Acquired projects are implemented and executed by CUTEC and its partners with technological know-how and technical equipment. Moreover, the DMU should assume an important role as a "pulse generator" for sustainable development strategies and a function as mediator between different cultures. (sr)

The Gas-Measuring Cell in the Project: "Biogas"

Development of a gas-measuring instrument for accurate recording of the gas yield from the anaerobic digestion of biomass on a laboratory scale

The limited availability of fossil energy sources, increasing economic and political dependence on oil-exporting countries, as well as the discussions on environmental policy during recent years, have resulted in increased utilisation of regenerative energy sources (Erneuerbare Energien Gesetz – EEG (Regenerative Energy Act) dated 1st April 2000). The use of residual organic materials as a source of energy with the application of anaerobic digestion for methane generation will thus receive increased attention. As a result of the progressive shift in emphasis from waste disposal in favour of electric power generation in plant design and construction, economic factors also have to be considered more carefully. By optimising the process parameters, as well as developments and adaptations of new processes (for example, pretreatment methods), the efficiency of biogas plants can be considerably enhanced. An economical real-time determination of the optimal substrate combination and process design which provide the maximal yield of methane and thus of energy is feasible only by anaerobic digestion experiments on a laboratory scale with precise measurement of biogas volumes.

The requirements imposed on such a measuring system for optimising the anaerobic digestion of biomass on a laboratory scale are complex.

Within the scope of a dissertation, CUTEC has now developed a new instrument for measuring biogas volumes during the anaerobic digestion of biomass on a laboratory scale in cooperation with the University of Clausthal and industrial partners. To a considerable extent, the project was financed by CUTEC itself, by the cooperating industrial partners, as well as by AIF as funding organisation of the program for innovation competence (ProInno) of small and medium-sized enterprises (SME).

Experimental set-up for determining very small gas volumes

During the initial operation of the measuring system in practical anaerobic digestion tests with biomass and sewage sludge, the measurements yielded precise and reproducible results.

Further developmental objectives include the integration of gas sensors for qualitatively determining the gas components as well as the possibility of shortening the anaerobic digestion times by simulation of the gas volume curves. With the application of these tools, energy and mass balancing during the anaerobic digestion of biomass should then be possible with the new measuring system.

In view of the high resolution and accuracy of the volume measurement, the high reproducibility of the gas generation, as well as automatic recording and evaluation of the results, the gas measuring system thus developed appears to be well suited for setting a new standard in measuring gas volumes from the anaerobic digestion of biomass on a laboratory scale. (schl)

In our interest:
We wish to congratulate Mr Schläfer for completing his doctorate with the project just described. (wes)

Cooperation with TU Ostrava

On 15th and 16th March, a 13-member delegation from the Technical University of Ostrava with its wealth of traditions in the Czech Republic were guests at our Institute. Under the leadership of Prof. Dirner, Prof. Figala, and Dipl.-Ing. Melecky, an introduction of the Technical University of Ostrava was first presented; this was followed by eight lectures on engineering topics. After an introduction by Prof. Carlowitz, the CUTEC profile was described. In a cordial atmosphere, the possibilities for cooperation were subsequently discussed. Concrete points of contact are already becoming evident in the fields of environmental analysis, safety engineering, regenerative energy sources, thermal treatment, and management of contaminated areas. A return visit for concretisation of projects has been planned for the autumn of this year. The delegation also visited the Board of Directors and selected institutes of the Technical University of Clausthal as a preparation for a cooperative agreement. (ze)

Emblem of the University of Ostrava

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New in the CUTEC team

Birgit Hickstein

Mrs. Hickstein at work in the laboratory

Since 1st January 2004, Dipl.-Biol. (FH) Birgit Hickstein has been supporting the Department of Physical and Biological Process Engineering; this applies especially to the work in the Biological Laboratory. Mrs. Hickstein received her training as a biological laboratory assistant at the *Institut für Tierzucht, Tierhaltung und Tiergesundheit* (Institute for Animal Breeding and Animal Health) in Oldenburg. She then completed a course of study in biotechnology at the *Fachhochschule* (University of Applied Sciences) in Oldenburg. At CUTEC, her field of work includes highly diversified activities in biotechnology and water treatment. She will thus provide valuable support for the expanding Division of Biological Process Engineering. (he/wes)

InfoSys in a new layout

Since the beginning of the year, the internal web page „CUTEC InfoSys“ for our employees has received an entirely new image. Although the presentation is still in the design phase, information from the Management can already be called up, and current news reports are available, too. In parallel with InfoSys, the web presentation of our Institute in the Internet (www.cutec.de) is currently being completely redesigned, too. (he)

DATES:

- CUTEC-Presentation:
  - Water + Gas, Berlin from 8th to 10th September at the Industrial Fair in Berlin
  - The BIG 5 SHOW from 20th to 24th November in Dubai, VAE

Report from the Workers' Council

Besides its other functions, the Workers' Council at CUTEC-Institut GmbH also participates in meetings of the Working Association of the Workers' Councils in the Upper Harz Mountain Region.

The economic structure of the Upper Harz Mountain Region is extremely fragile. The overall picture is characterised by small family businesses, very few larger companies, as well as the Technical University of Clausthal. In order to focus public attention on existing and impending difficulties, company problems such as dismissals or shut-downs should be publicised to an increasing extent in the future.

During the February meeting, it was also decided to invite referees to discuss special topics. In this manner, the Workers' Councils hope to foster consciousness of the problems involved in the Upper Harz Mountain Region. (schr)

University Championship title: Handball and Unihockey

During the University Championship in Unihockey, the CUTEC team placed first against seven other teams and is now university champion for the first time in this sport.

After having achieved second place in 2003, the CUTEC Handball Team secured the University Championship title for 2004 at the second attempt. The victorious CUTEC team competed with a total of six teams in this year's contest.

The participants in the Unihockey championship were:

Sebastian Rubin, Michael Schindler, Thomas Westermann, Nadine Senkel, Anke Dempke.

The members of the competing handball team were:

Tobias Stahl, Sebastian Rubin, Markus Maly, Holger Jüptner, Holger Thiel, Tobias Oelmann, René Meise, Peter Klemp, Mathias Marks. (my)

Scientific Advisory Council at CUTEC: Prof. em. Dr.-Ing. Michael F. Jischa – a personal profile

Prof. em. Dr.-Ing. Michael F. Jischa

Prof. Jischa, born in Hamburg in 1937, studied „aircraft and automotive engineering“ at the *Ingenieurschule* in Hamburg after completing his training as an automobile mechanic. After a brief period of industrial activity, he began a course of study in mechanical engineering at the *Technische Hochschule* in Karlsruhe, which he completed in 1965 with the degree of Diplom and receipt of the *Redtenbacher* prize. He performed research and instructed at the Universities of Karlsruhe, Berlin (TU, doctorate in 1968 and Habilitation, 1971, in fluid mechanics), Bochum (professor at the Institute of Thermo- and Fluid Dynamics), Essen (1974 professorship in fluid mechanics) and Clausthal (1981 professorship in technical mechanics). As a visiting professor, he worked in Haifa (Technion), Marseille, and Shanghai. As a secondary occupation, he was Managing Director of the *Deutsche Technische Akademie* in Helmstedt from 1989 to 1993. He is the author of the engineering textbook *"Konvektiver Impuls-, Wärme- und Stoffaustausch"*, the nonfiction *"Herausforderung Zukunft"*, and the student textbook, *"Ingenieurwissenschaften"*. Furthermore, he is President of the *Deutsche Gesellschaft* Club of Rome as well as a member of the jury for the *Deutscher Umweltpreis*, of the Board of Trustees for the *Hanns-Lilje-Stiftung* (Hanns Lilje Foundation), the *Bereichsvertretung Gesellschaft und Technik im Verein Deutscher Ingenieure*, of the Program Advisory Council *Nachhaltigkeit und Technik* at the Research Centre in Karlsruhe, and the Advisory Council for the *Fachbereich Umweltwissenschaften* (Department of Environmental Sciences) at the University of Lüneburg.

He has been associated with CUTEC for a long time, first as a member of the Board of Directors, then as Chairman of the University Advisory Council, and as a member of the Scientific Advisory Council since 2002. His recommendation for CUTEC: "Under the primacy of sustainability, the excellent competence of CUTEC in many fields of environmental engineering will become even more effective if it is applied within a broader context, let us say as sustainability management". (he)